

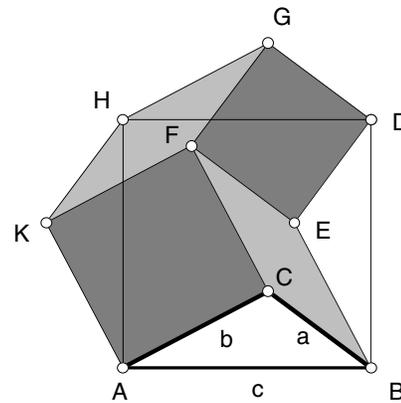
# The Law of Cosines

Name(s): \_\_\_\_\_

The Pythagorean theorem gives you a way to find the length of one side of a right triangle if you know the lengths of the other two sides. Trigonometry builds on the Pythagorean theorem with theorems that enable you to find the measures of all the parts of a triangle given measures of parts that determine the triangle. With the law of cosines, you can find the measure of an unknown side of any triangle given the measures of the other two sides and the angle between them (SAS). In this activity, your construction will demonstrate the law of cosines for obtuse triangles. To understand how the figure demonstrates it, you'll need to know a little trigonometry.

## Sketch and Investigate

1. Construct a square and label the bottom side  $c$ .
2. Construct  $\triangle ABC$  where  $C$  is any point inside the square that makes  $\angle C$  obtuse. Give segments  $AC$  and  $BC$  the labels  $b$  and  $a$ .
3. Construct a square on side  $b$ .
4. On side  $a$  of the triangle, construct parallelogram  $CBEF$  as shown.
5. On the side of this parallelogram opposite side  $a$ , construct another square.
6. Construct segments  $GH$  and  $HK$  to complete a second parallelogram, as shown. Construct the interiors of the parallelograms and squares.



Any reference to  $\angle C$  in this activity will refer to  $\angle ACB$ .

Make sure to use **Parallel Line** from the Construct menu. Don't just "eyeball" it.

- Q1** Drag point  $C$ . What do you notice about the two parallelograms (as long as  $\angle C$  is obtuse)? What happens when  $\angle C$  becomes a right angle?
- Q2** The area of your original square is  $c^2$ . How does that compare to the sum of the four areas you constructed (the two squares and two parallelograms)?
- Q3** If you know some trigonometry, write an expression for the area of one of the parallelograms in terms of  $a$ ,  $b$ , and  $\angle C$ .
- Q4** Use this expression and what you discovered about the sum of the areas of the squares and parallelograms to complete the law of cosines:  $c^2 = (?)$